

Report on research in progress

PROJECT TEAM.

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Funding agency:

Project is funded by the European Commission under the
6th Framework Programme,
IST Programme, Priority 2.3.1.11 – eHealth.
Contract No.: IST-2002-507424

Summary

The ALLADIN project is a pan-European research initiative, investigating recovery post stroke, and the role of the language descriptions of physiotherapists in creating decision support software.

The project began in January 2004 and will be ongoing until March 2007. It involves partners from

- Arteveldehogeschool, Belgium
- Language and Computing NV, Belgium
- Budapest University of Technology and Economics, Hungary
- University of Ljubljana, Slovenia
- Zenon SA, Robotics and Informatics, Greece
- Multitel ASBL, Belgium
- Trinity College Dublin, Ireland
- Scuola Superiore Sant'Anna, Italy
- National Institute for Medical Rehabilitation, Hungary

Introduction

Rehabilitation context

Stroke is a major social and health care issue. In the UK, it is estimated that every five minutes, someone has a stroke (Stroke Association, 2005). It is the most common cause of acquired physical disability in adults (Irish Heart Foundation 2000, Stroke Association, 2005). While the estimated cost of health care for an individual who makes a swift recovery is approximately £2,000, this increases 30-fold if slower and longer term care is required. The European Brain Council estimates that in the EU and EFTA six million people have survived stroke and that the total cost of stroke in Europe in €21,895,000,000.

Predicting recovery within the context of physiotherapy following stroke is difficult. As a profession, we are still developing measurement instruments to support our decision-making, still deciding what standardised outcome measures (SOM) should be used (Salter et al 2005) and, indeed, exploring models to support how decisions about evidence-based intervention can best be informed (Herbert et al 2005). Herbert et al (2005) suggest that a combination of information may have to be used to inform clinical decision-making and support the efficacy of physiotherapy intervention – a combination of the output of standardised measures and the results of scientific enquiry. We have moved from a time when

routine standardised outcome measurement within physiotherapy practice was not employed – Partridge (1982) reports in a paper in the 1980s that information about specific changes that occur in patients during a course of treatment is not usually recorded, outcome being described in terms of the patient 'getting better', 'improving' or being discharged' – into a period where it has become increasingly recognised that measurement, within the context of a skilled assessment, is necessary in rehabilitation therapy.

Nonetheless, there continue to exist barriers to the systematic use of SOMs in decision-making in physiotherapy practice (Kay et al 2001, Stokes & O'Neill 2006). In addition it has been observed that while it was accepted that the use of client outcome measures had become intrinsic in physiotherapy practice, consistent application was not uniform, and the utilisation of the information gathered in a meaningful way lags behind the collection of data (Huijbregts et al 2002).

Decision support systems in clinical practice

The increased life expectancy of the population and the mounting medical expertise in stroke care has increased the number of people with stroke in the community. The difficult decisions regarding whether or not recovery has reached a plateau phase has implications for the use of healthcare resources. Continuing to spend valuable rehabilitation time with a person who will not make any further recovery may be costly to the health service, while stopping therapy when functional recovery is still possible may be detrimental to the long-term outcome of a person with stroke.

Physiotherapists do not have any standardised method of judging this fine line, and historically have used experience and patient report to come to the decision. The use of SOM can inform the decision, but since they may not be widely and systematically used, physiotherapy could benefit from the advances that have been made in decision support systems in other areas.

Decision support is a technique that has long been used in the science and manufacturing industries, with success in increasing efficacy of work practices and productivity. The increasing demands on healthcare resources and the need for transparency within the rehabilitation setting have resulted in a role for decision support in rehabilitation also. Decision support is said to utilise the vast quantities of information available on a person with stroke to provide a projected outcome for that person. Decision support systems have already been successfully implemented in terms of management of dysphagia in an acute stroke unit (Zheng et al 2005), and in the evaluation of a home rehabilitation program for people with stroke (Runnions et al 2004).

ALLADIN, is a research project funded by the EU, and encompasses the design, development and evaluation of one such decision-support system. The theoretical framework is based on exploring the relationships between 'natural language' descriptions of the functional

status of a person with stroke-specific objective measurements from a force-torque measuring device and SOM.

The ALLADIN project

The ALLADIN project merges several Information Communication Technologies (ICT), such as natural language understanding and speech processing, with clinical practice. The development of natural language-based decision support software requires comparison of natural language descriptions with objective measurements from the force-torque measuring device – the ALLADIN Diagnostic Device (ADD) – and the SOMs.

The natural language database comprises 16 descriptions of each participant in the trial. A significant volume of work was necessary to facilitate the recording of natural language. Initially, physiotherapists were asked to generate a series of fictional descriptions of people with stroke, at various stages of recovery. The language used here informed the creation of a taxonomy – a series of words grouped together in classifications – which was later developed into an ontology – a description of the relationships of the words and classifications. Explicitly, the ontology refers to the sentence structure matrix created to facilitate the use of natural language descriptions of the status of the person with stroke. In this way, the three clinical sites have similar sentence structure, to allow for comparison of the data.

The ADD is a force-torque measuring device that measures any movement initiated. It was developed by engineering and computer science experts throughout Europe. The device was created following identification of six activities of daily living that could be completed in sitting. These include: drinking from a glass; turning a key; lifting a spoon; lifting a bag; reaching for a bottle and moving a bottle. Sensors measure at the thumb, fingers, arm, trunk, seat, foot and big toe, while each activity is shown on a monitor.

Figure 1 below shows a person in the ADD during a measurement session, while figure 2 shows the therapist inputting the natural language description to the Personal Digital Assistant (PDA).

Aims of the ALLADIN project

The ALLADIN project focuses on the development of a

user-friendly natural language based decision support software for neuro-rehabilitation, with a specific focus on stroke. This software may offer a new reliable standard for calculating and predicting the functional recovery of people with stroke, which is a crucial factor in client centred evidence based practice, discharge planning and the utilisation of rehabilitation resources.

Objectives

1. *To develop a low cost, easy to use, 36-channel force/torque-measuring instrument that samples data on the performance of ADL's in people with stroke.*

This is the ALLADIN Diagnostic Device (ADD); it was completed in January 2005 and installed in the three clinical sites by March 2005. To date, almost 300 people have participated in the clinical trial, 84 in Dublin.

2. *To identify a number of evidence-based markers and milestones of recovery following a stroke.*

This will be completed by evaluating the state of the art regarding indicators of recovery following stroke, by means of a literature review. The findings of this literature review will be compared to the data gathered on the people with stroke by the ADD and the natural language descriptions. Following statistical review and data-mining, the process is expected to identify approximately 10 milestones in recovery and 30 predictive markers for functional improvement in stroke, analogous with the International Classification of Functioning and Disabilities (ICF) codes.

3. *To develop evidence-based decision support system.*

This will utilise the information on markers and milestones, and link it with the natural language descriptions of people with stroke. There will be an expansion of the ontology, to include approximately 250 concepts and 2,500 terms, increasing the usefulness of the system in clinical practice. The use of the natural language understanding technology will convert language descriptions into a nomenclature specific to stroke, for use by rehabilitation professionals. This nomenclature will create a situation whereby clinical assessments and quantitative measurement become interchangeable.

4. *To integrate the natural language decision support software with the hospital information system.*

This will provide the clinician with a speech interface

Figure 1

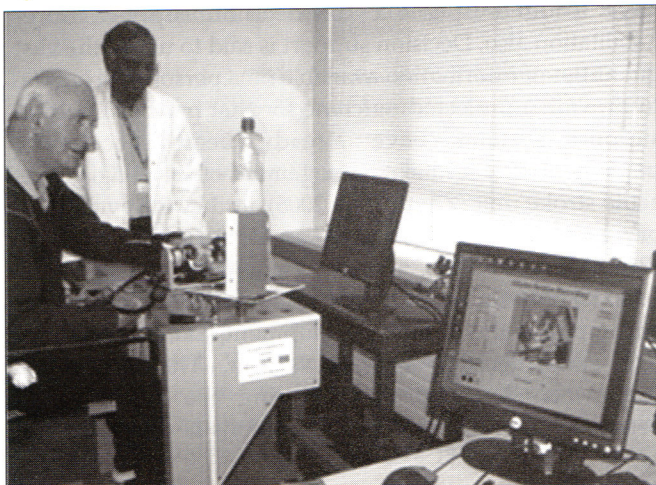


Figure 2



into which a vocal description of the status of the subject can be inputted, for example using a PDA and a PC. Speaking into the PDA while assessing a patient will capture the 'natural language' description. Docking the PDA and uploading the information to a PC will inform the clinician about the stage of recovery and will support further decisions at the rehabilitation level. All members of the multi-disciplinary team can readily access the status of each person with stroke, as ALLADIN provides the physician and therapist with an easily interpretable and a universal standard report on functional diagnosis and outcome prediction.

Methodology employed

Each participant in the ALLADIN trial is seen by the research team twice a week for the first eight weeks, and once a week for the next 16 weeks of their recovery. Each session has two distinct parts:

1. The ADD, the ALLADIN diagnostic device.

This system uses sensors placed at the arm, fingers, thumb, trunk, seat, foot and big toe on the hemiplegic side to record force-torque movements while the participant attempts six activities of daily living. These activities are:

- Drinking from a glass
- Turning a key
- Grasping a spoon
- Lifting a bag
- Reaching for a bottle
- Moving the bottle.

These activities are demonstrated on a monitor, and the person repeats each one three times.

2. The Natural Language description or a Standardised Outcome Measure.

Each session involves either a natural language description or the administering of a standardised outcome measure, on alternate sessions. The natural language description comprises of a normal physiotherapy assessment of the participant. The findings of the assessment are then recorded in speech files to a PDA. These speech files are later uploaded to the database and checked for consistency.

The standardised outcome measures used in the study are the Fugl-Meyer Assessment of Motor Function and the Motor Assessment Scale. These are also administered on alternate sessions. In addition, the Stroke Impact Scale is completed three times during the trial.

In total, each participant has 32 sessions on the ADD, 16 natural language descriptions, eight Fugl-Meyer sessions, eight Motor Assessment Scale sessions and three Stroke Impact Scales during the ALLADIN clinical trial.

End Products

The main end product of the project is user-friendly natural language based decision support software. This software automatically generates a code comparable with ICF code, linked to a marker or milestone in functional recovery and informs the clinician on the status of the patient.

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There are also two possible by-products:

1. A mecha-tronic whole-body isometric force-torque functional tasks measurement system, the Alladin Diagnostic Device (ADD). This device explores the sensory-motor reorganisation after stroke by evaluating the routine functional tasks
2. A force/torque sensor based virtual reality therapy device for hand function in neuro rehabilitation. This device will have the capability to create an exercise environment where the intensity of practice and positive feedback can be consistently and systematically manipulated and enhanced to create an individualised motor approach.

References.

- European Brain Council, 2005. Accessed on 03/02/06 at <http://www.europeanbraincouncil.org/pubInfo.htm>.
- Herbert R, Jamtvedt G, Mead J, Birger Hagen K. (2006) Editorial: Outcome measures measure outcomes, not effects of interventions. *Australian Journal of Physiotherapy* 51(1):3-4.
- Huijbregts MPJ, Myers AM, Kay TM, Gavin TS. (2002) Systematic outcome measurement in clinical practice: challenges experiences by physiotherapists. *Physiotherapy Canada* 54:25-31,36.

- Irish Heart Foundation, Council on Stroke (2000) *Towards excellence in stroke care in Ireland*. Dublin: Eireann Health Publications.
- Kay TM, Myers AM, Huijbregts MPJ. (2001) How far have we come since 1992? A comparative survey of physiotherapists' use of outcome measures. *Physiotherapy Canada* 53:268-275,281.
- Partridge CJ. (1982) The outcome of physiotherapy and its measurement. *Physiotherapy* 68(11): 362-363.
- Runnions S,, Rodigue N, White C. (2004) Practice on an acute stroke unit after implementation of a decision-making algorithm for dietary management of dysphagia. *Journal of Neuroscience Nursing*. 36(4): 200-207
- Salter K, Jutai JW, Teasell R, Foley NC, Bitensky J (2005) Issues for selection of outcome measures in stroke rehabilitation: ICF Body Functions. *Disability & Rehabilitation* 27(4):191-207.
- Stokes EK, O'Neill D (2006) (In preparation)
- Stroke Association, 2005. Accessed on 03/05/06 at <http://www.stroke.org.uk/information/index.html>.
- Zheng H, Davies RJ, Black ND. (2005) Web-based monitoring system for home-based rehabilitation with stroke patients. In the *Proceedings of the 18th IEEE Symposium on Computer-Based Medical Systems*. (CBMS '05). ■

ISCP CONFERENCE 2006

The annual ISCP conference will take place on the 10th and 11th November 2006 in Croke Park. The conference will be run in conjunction with CSP Northern Ireland, and the organising committee is delighted to welcome them on board, and to tap into their valuable experience and suggestions for speakers.

The theme of this year's conference will be "**Broadening Horizons**". The committee aims to accommodate all needs, and the conference targets new ideas and initiatives. We feel that there will be something for everyone – managers, therapists working in community and rehabilitation, musculoskeletal, respiratory, paediatrics, women's health and sports.

We are at the final stages of organising pre- and post -conference courses from some of the keynote speakers – look out for details of these in the Diary of Events.

If you have any queries, please contact Emma McGrane, committee chairperson, at emma.mcgrane@amnch.ie

Please note that abstracts for the conference need to be submitted for review by the 16th of June, 2006. See www.iscp.ie for further details on this.

We will have further details on the conference programme in forthcoming editions of *Firsthand*.

• **Sinead Kelly, PRO**

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REPORTS

Secretaries are reminded to send in their monthly reports for the July issue of *Firsthand* **before 13th June please.**

Please also submit entries for the Diary of Events before 13th June, **indicating clearly** whether you want an **eighth-page advertisement**, or just a **single line entry in the listings section.**

Thank you for your co-operation.